Revue suisse de Zoologie 113 (1): 95-113; mars 2006

The Raymondionymidae of the Curti collection, with description of *Raymondionymus curtii* sp. n. (Coleoptera, Curculionoidea)

Massimo MEREGALLI[1], Giuseppe OSELLA[2], Anna Maria ZUPPA[2]
[1] Dipartimento di Biologia Animale e dell'Uomo, Università di Torino, V. Accademia Albertina 13, I-10123 Torino, Italia.
E-mail: massimo.meregalli@unito.it
[2] Dipartimento di Scienze Ambientali, Università di L'Aquila, loc. Coppito, I-67100 L'Aquila, Italia. E-mail: osella@univaq.it

The Raymondionymidae of the Curti collection, with description of *Raymondionymus curtii* sp. n. (Coleoptera, Curculionoidea). - The Coleoptera Curculionoidea Raymondionymidae collected by Marc Curti and preserved in the Muséum d'histoire naturelle, Geneva, Switzerland were studied. A list of the 16 species and all specimens is given. Taxonomy, mutual relationships and distribution range of *R. ochsii, R. problematicus* and *R. orientalis* are discussed. *R. curtii* sp. n. (type locality: Italy, Piedmont, Valle Varaita, Castello, 44°37'N 07°03'E) is described. *R. sanfilippoi* is a new record for the French fauna. Short remarks on the relationships among some species of the genus are also given.

Keywords: Coleoptera - Curculionoidea - Raymondionymidae - taxonomy - new species - Curti collection.

INTRODUCTION

Our friend and colleague Dr Ivan Löbl has proposed us to study a rich collection of endogeic weevils collected by the French entomologist Marc Curti, including many species of Raymondionymidae. This collection is extremely important for the knowledge of the endogeic weevil fauna, in particular of the south-western Alps and southern France, where only occasional researches had been previously carried out, in particular by Hervé (1949, 1950, 1953). It allows a significant contribution to the knowledge of chorology and systematics of some French and Italian taxa of the family, and includes a new species, which is described here.

MATERIAL AND METHODS

Specimens examined are housed in the following collections: Muséum d'histoire naturelle, Geneva, Switzerland (MHNG); coll. Meregalli, Turin, Italy (MER); coll. Osella, L'Aquila, Italy (OSL). Several specimens for each species were dissected, female genitalia were embedded in Canada balsam and male genitalia were mounted dry. Genitalia preparations are pinned below the respective specimen. The photographs

Manuscript accepted 21.03.2005

were taken with a Nikon Coolpix 4500 Digital camera, on a Wild Stereomicroscope, with 10x oculars, and elaborated with Adobe Photoshop 7.0. The type material and all the other available specimens cited by Osella (1977), Osella & Giusto (1985) and Osella & Abbazzi (1985) of *R. andreinii* (Osella, 1977), *R. bartolii* (Osella, 1977), *R. gardinii* (Osella & Giusto, 1985), *R. magnificus* (Osella, 1977), *R. meggiolaroi* (Osella, 1977), *R. mingazzinii* (Osella & Abbazzi, 1985), *R. mirabilis* (Osella, 1977), *R. sanfilippoi* (Osella & Giusto, 1985), *R. stricticollis picenus* (Osella, 1977) and *R. zoiai* (Osella & Giusto, 1985) were examined; data for further specimens of these and other species not included in the papers cited above are reported in the remarks chapter under the relative species. Except when otherwise indicated, the specimens belong to the Curti collection and are housed at MHNG. "Collecting data" are cited verbatim according to labels. The symbol "Ω", used by Curti in some labels, means "grotte" (*cave*).

LIST OF THE SPECIES AND TAXONOMIC REMARKS

Alaocephala delarouzei coiffati Hoffmann, 1958
Alaocephala delarouzei coiffati Hoffmann, 1958: 1749.

FRANCE, PYRÉNÉES ORIENTALES: "Monbollo, Py. or., 23.X.1974, Leg. Curti M.", 1 ex.

Raymondionymus perrisi (Grenier, 1864)
Raymondia perrisi Grenier, 1864: 137.

FRANCE, HAUTE GARONNE: "Arbas N.E., Ω Goucildi, Her., 15.X.1964", 1 ex. – FRANCE, ARIÈGE: "Gouffre de Italiens, Cogire, H.te Gar., 8.VIII.1977, ± 30 m, Leg. Curti M.", 3 exs; "Barjac, Ariège, St. Lizier, 5.VIII.1977", 5 exs (3 exs MHNG; 1 ex. MER; 1 ex. OSL); "Taurignan vieux, Ariège, 11.VIII.1970, Leg. Curti M. / entrée de la grotte Touesse", 1 ex.; "Col de la Crauzette, Ariège, 19.VIII.1977, Leg. Curti M.", 1 ex.; "Grotte d'Aubert, Ariège, 20.VIII.1977, Leg. Curti M.", 2 exs; "Grotte du Cap de la Bouiche, Ariège, 29.VIII.1977, Leg. Curti M.", 1 ex.; "Lac de Betmale, Ariège, 4.VIII.1977, Leg. Curti M., 1 ex. – FRANCE, BASSES PYRÉNÉES: "Larrau, Bass. Pyr., 20.IX.1979, Leg. Curti M.", 2 exs; "Bois du Bager d'Olor., Oloron, B. Pyr., 21.IX.1979, Hêtraie, Leg. Curti M.", 1 ex.; "Bois du Bager, Oloron, B.P., 20.IX.1979, vers Oloron", 2 exs; "Arette, B. Pyr., Ambielle, 24.IX.1979, Leg. Curti M.", 3 exs (2 exs MHNG, 1 ex. MER).

Raymondionymus laevithorax (Perris, 1875)
Raymondia laevithorax Perris, 1875: 11.

FRANCE, CORSICA: "Ω Zabara: Port do Castirla, 24.IX.1973, Corse, Leg. Curti M.", 1 ex.

Raymondionymus laneyrei Hervé, 1949
Raymondionymus laneyrei Hervé, 1949: 133.

FRANCE, VAR: "La Garde Freynet, Var, 3.XI.1966", 2 exs (1 ex. MHNG; 1 ex. MER); "La Garde Freynet, Var, Tirasol, 5.X.1969", 1 ex.; "La Garde Freynet, Var, Tirasol, 8.X.1966", 1 ex.

Raymondionymus lavagnei Mayet, 1898

Raymondionymus lavagnei Mayet, 1898: 87.

France, Herault: "Mireval, Herault, 22.III.1972, Leg. Curti M.", 1 ex.

Raymondionymus ochsi Hervé, 1949

Raymondionymus ochsi Hervé, 1949: 136.
Pararaymondionymus ochsi (Hervé): Osella, 1977: 53.

Raymondionymus problematicus Hervé, 1949

Raymondionymus ochsi race *problematicus* Hervé, 1949: 137.
Pararaymondionymus ochsi ssp. *problematicus* (Hervé): Osella, 1977: 53-54, partim.

Raymondionymus orientalis Hervé, 1953

Raymondionymus hoffmanni var. *orientalis* Hervé, 1953: 9-11.
Pararaymondionymus orientalis (Hervé): Osella, 1977: 54.
Pararaymondionymus ochsi ssp. *problematicus* (Hervé): Osella, 1977: 53-54, partim.

Remarks. The conspicuous material (about 80 exs) collected by Curti allows understanding the mutual relationships among these three closely related, and morphologically very similar, taxa.

Osella (1977) could not examine specimens from the type localities of *R. ochsi* and *R. problematicus* and derived his taxonomic interpretation from the various comments by Hervé (1949, 1950, 1953). In particular, Osella (1977: 54) considered *R. ochsi* composed of two subspecies, the nominal subspecies from the surrounding of Vence, and the subspecies *R. ochsi problematicus*. The author attributed to this subspecies all the specimens he examined from the Maritime Alps, between Beuil, the type locality of *R. ochsi* «race» *problematicus* Hervé, and the Italian province of Imperia (various localities between 800 and 1500 m). *R. orientalis*, whose type locality is Albarea, near Sospel, thus within the range of *R. ochsi problematicus* sensu Osella (Osella, 1977: 152, map 4), was maintained as a distinct species.

The specimens in coll. Curti clarify that the three taxa are differentiated at species rank and are apparently allopatric (Fig. 72). They can be differentiated as indicated in Table 1.

Raymondionymus ochsi Hervé, 1949 Figs 4, 6-7, 10-11, 21-24, 56-57, 63-64

Specimens in Curti collection:

France, Alpes Maritimes: "Vence, A. M., 12.IV.1968", 1 ex.; "Vence, A. M., V. 1965, Riou, Leg. Curti M.", 5 exs (3 exs MHNG; 1 ex. MER; 1 ex. OSL); "Le Bar, A. M., 3.V.1981, Leg. Curti M.", 1 ♀; "Le Bar, A. M., Hubai, 27.III.1982, Leg. Curti M.", 1 ♀; "Menton, A. M., 15.III.1968", 1 ex.; "Beausoleil, 9.II.1972, A. M., Tunnel Corniche, Leg. Curti M.", 1 ex.; "Eze, A. M., 21.V.1969, P.te Funel, Vallon, Leg. Curti M.", 1 ex., "Eze, A. M., 24.IV.1968, Vallon, P.te Funel, Leg. Curti M.", 2 exs (1 ex. MHNG; 1 ex. MER); "Eze, A. M., 21.IV.1969, Vallon, P.te Funel, Leg. Curti M.", 1 ex.

Other specimens examined:

France, Alpes Maritimes: "Roquefort les Pins, A. M., capturé le 10.II.1979, piegé le 15.IV.1978, Grotte, Coll J.C. Jordan", 1 ♂ (OSL).

TABLE I

Morphological differentiation of *Raymondionymus ochsi*, *R. problematicus*, *R. orientalis*.

Raymondionymus ochsi	*Raymondionymus problematicus*	*Raymondionymus orientalis*
Rostrum: slender, ratio length/width 4.6, in lateral view upper margin of scrobe reaching lower margin of rostrum (Fig. 4); dorsum weakly convex transversely; dorso-lateral margins moderately curved inwards, minimum width in the first half, setae on sides inserted in low granules, visible from above.	*Rostrum:* very slender, ratio length/width 5.2, in lateral view upper margin of scrobe running sub-parallel to lower margin of rostrum (Fig. 1); dorsum flattened, dorso-lateral margins weakly but distinctly compressed, curved inwards, minimum width at mid length between base and insertion of antennae; sides with setae not inserted in microscopic granules.	*Rostrum:* shorter and stouter, ratio length/width 4.2; in lateral view upper margin of scrobe not reaching lower margin of rostrum (Figs 2-3); dorsum transversely convex, dorso-lateral margins indistinctly curvilinear, minimum width near base, regularly widened up to insertion of antennae; sides with scarcely differentiated granules.
Antenna: Segment 2 1.5 x longer than wide, half as long as 1; segment 3 two thirds as long as 2 (Figs 6-7)	*Antenna:* funicle thin, at least segments 1 to 4 longer than wide, segment 3 nearly as long as 2 (Fig. 5).	*Antenna:* funicle with only segments 1-3 longer than wide, segment 3 distinctly shorter than 2 (Figs 8-9).
Pronotum: sides very regularly rounded (Figs 63-64), not constricted towards apex, maximum width slightly beyond mid of length; punctures regularly impressed, slightly smaller than those of the striae; interspaces nearly as wide as the punctures; median line scarcely distinct; sides with small granules below the punctures.	*Pronotum:* sides weakly and regularly rounded (Fig. 65), not constricted towards apex, maximum width at middle of length; punctures on dorsum large, dense near base and smaller, more spaced towards apex, where interspaces are at least as wide as or wider than the punctures; median line distinct for nearly the whole length; granules on sides indistinct.	*Pronotum:* sides broadened, constricted and slightly sinuate at apex (Figs. 66-68), maximum width slightly beyond middle of length; dorsum with large dense punctures, interspaces usually narrower than the punctures, median line usually distinct; anterior half with minute raised granules, higher on sides and near apex.
Elytra: sides weakly curvilinear; intervals with minute but visible granules, usually mainly distinct on interval 7 when seen from above.	*Elytra:* sides subparallel; intervals smooth, lacking acute microscopic granules.	*Elytra:* sides weakly curvilinear; intervals with minute but visible granules, usually mainly distinct on interval 7 when seen from above.
Fore tibia: moderately and regularly thickened at middle of length, outer margin with about 4-5 isolated teeth and long setae, moderately narrowed before apex; fringe reduced to a series of single broad setae (Figs 10-11).	*Fore tibia*: scarcely broadened with maximum broadness, and longest tooth, at two/thirds of length, strongly constricted before apex; outer margin with 2-3 very prominent teeth and few isolated setae; fringe of setae missing, replaced by 5-6 isolated short broad setae evenly spaced (Fig. 12)	*Fore tibia:* broadly thickened at middle of length, nearly straight before apex; outer margin with few short and small teeth and isolated setae; fringe of setae towards apex variable, relatively dense or reduced to a series of broad setae (Figs 13-14).
Aedeagus: Figs 21-24.	*Aedeagus:* Figs 19-20.	*Aedeagus:* Figs 15-18.

The specimens in coll. Curti expand the range of *R. ochsi* from the surroundings of Vence, the type locality, along the Mediterranean coast up to Menton. The specimens from the type locality are very uniform for most of the morphological traits; the most significant variation regards the punctures on the striae, which can be slightly broader. A *Raymondionymus* from Le Bar was cited by Osella (1977: 57) as *R. hoffmanni,* based on an identification by Hervé. However, the two ♀♀ ex coll. Curti from Le Bar do not show any significant difference with respect to *R. ochsi.* This is also the case of the ♂ from Roquefort les Pins, a locality not far from Cannes. The specimens from the eastern part of the range, along the Mediterranean coast, have stouter rostrum, with subparallel dorso-lateral margins, slightly narrower elytra, with sides subparallel for most of their length and fore tibiae with slightly less prominent teeth. In the eastern part of the range *R. ochsi* lives very near to *R. orientalis,* but it seems to be usually associated to xerophyll woods in drier, Mediterranean habitats, at lower altitude. *R.ochsi* and *R. orientalis* are well distinct, although morphological differences are small. Aedeagus is a key-trait allowing differentiation (Figs 17-18; 21-24).

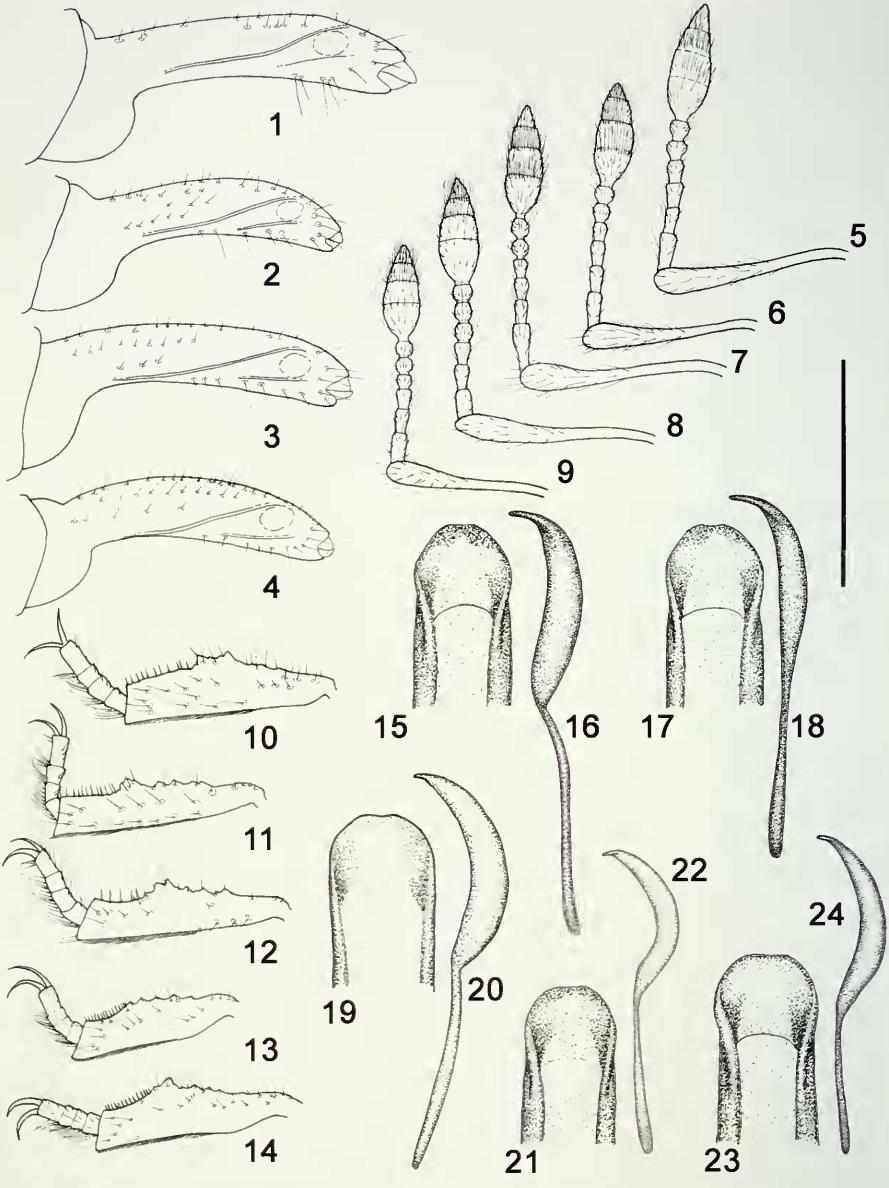
Raymondionymus problematicus Hervé, 1949 Figs 1, 5, 12, 19-20, 62, 65

France, Basses Alpes: "S. Annot, B.A., 20.VI.1974", 1 ♂. – France, Alpes Maritimes: "Valberg, A. M., VI 1975", 1 ♂; "Valberg, A. M., 10.VII.1975", 1 ♀; "Covillote, A. M., 4.IX.1966", 2 ♀♀ (1 ♀ MHNG; 1 ♀ MER); "Peone, A. M., 20.V.1975", 1 ♀.

R. problematicus was described from Beuil. Five ♀♀ in coll. Curti were collected in the surroundings of Beuil (Valberg, Covillote, Péone); they are very uniform for all the morphological traits; a sixth specimen, and the only ♂ examined, comes from Annot, a locality about 30 km south-west of Beuil, in the right side of the river Var valley; it does not differ from the previous specimens, but by the slightly broader pronotum.

The two ♀♀ from Mont Mounier cited by Osella (1977: 54) as *P. ochsi problematicus* are confirmed to belong to *R. problematicus*, whereas the specimens from Moulinet, referred by Hervé (1949) to *R. ochsi* «race» *problematicus,* should be attributed to *R. orientalis*, as suggested by the two specimens collected by Curti. These, indeed, have slightly more slender fore tibiae, with sharper and more prominent teeth and slightly narrower prothorax and elytra, showing thus an apparent similitude with *R. problematicus*; however, the most prominent tooth is at mid length of the fore tibia, and is followed by denser apical setae; also the pronotum, sinuate and granulose at the apex, confirms the attribution of this population to *R. orientalis*, in agreement with its geographical distribution.

The rank of the epithet *problematicus* Hervé, 1949, originally named as «race», is subspecific according to Art. 45.6 ICZN (1999), as the author explicitly proposed it as such: "Il s'agit d'une race bien différencée et peut-être d'une espèce distincte" (Hervé, 1949: 137) (*It is a well differentiated race and perhaps a different species*). Therefore, the epithet can be applied to this taxon with Hervé, 1949 as the author.



FIGS 1-24

Raymondionymus problematicus, ♀, France, Alpes Maritimes, Covillote: rostrum, ♀ (1); antenna (5). *R. problematicus,* ♀, France, Alpes Maritimes, Valberg: fore tibia (12). *R. problematicus,* ♂, France, Alpes Maritimes, S. Annot: aedeagus (19-20). – *R. orientalis,* ♂, France, Alpes Maritimes, Col de Castillon: rostrum (2); antenna (9); fore tibia (13); aedeagus (15-16). *R. orientalis,* ♂, Italy, Liguria, Colle Melosa: rostrum (3); antenna (8); fore tibia (14); aedeagus (17-18). – *R. ochsi,* ♂, France, Alpes Maritimes, Vence: rostrum (4); antenna (6); fore tibia (11); aedeagus (21-22). *R. ochsi,* ♂, France, Alpes Maritimes, Eze: antenna (7); fore tibia (10); aedeagus (23-24). – Bar: Figs 1-14, 16, 18, 20, 22, 24: 0.5 mm; figs 15, 17, 19, 21, 23: 0.25 mm.

Raymondionymus orientalis Hervé, 1953 Figs 2-3, 8-9, 13-14, 15-18, 58-59, 66-68

FRANCE, ALPES MARITIMES: "Sospel, La Vasta, A. M., 10.VI.1973", 2 exs; "Col de Castillon, A. M., 8.IV.1972, Leg. Curti M.", 3 exs; "Col de Castillon, A. M., 9.IV.1973", 10 exs (6 exs MHNG; 2 exs MER; 2 exs OSL); "Peille, Banquette, A. M., 13.V.1960, Leg. Curti M.", 5 exs; "Peille, A. M., 13.XII.1976", 1 ex.; "Casterino, A. M., 27.VI.1974, Biaso, m 1850, Leg. Curti M.", 5 exs; "Le Moulinet, A. M., vers 900 m, 25.VI.1975, Leg. Curti M.", 2 ♀♀; "Bois de Sanson, 22.VII.1974, La Brigue, Leg. Curti M.", 1 ex. – ITALY, LIGURIA: "lav. Melosa, Italie, VII.75", 9 exs (5 exs MHNG; 2 exs MER; 2 exs OSL); "Pigna, Melosa, Italie, 25.V.1973, Leg. Curti M.", 7 exs (5 exx MHNG; 1 ex. MER; 1 ex. OSL); "Colle Melosa, Italie, Pigna, 14.VII.1976, Leg. Curti M.", 4 exs; "Melosa, Italie, Pigna, m 2000, 2.X.1975, Leg. Curti M.", 5 exs; "Passo di Guta, Italie, Pigna, 7.VI.1960, Leg. Curti M.", 1 ex.; "Gouta, Italie, Pigna, 25.VI.1974, Leg. Curti M.", 3 exs; "Upega, Pont, 13.V.1973, Leg. Curti M., 2 exs; Upega, Italie, 25.V.1972", 1 ex.

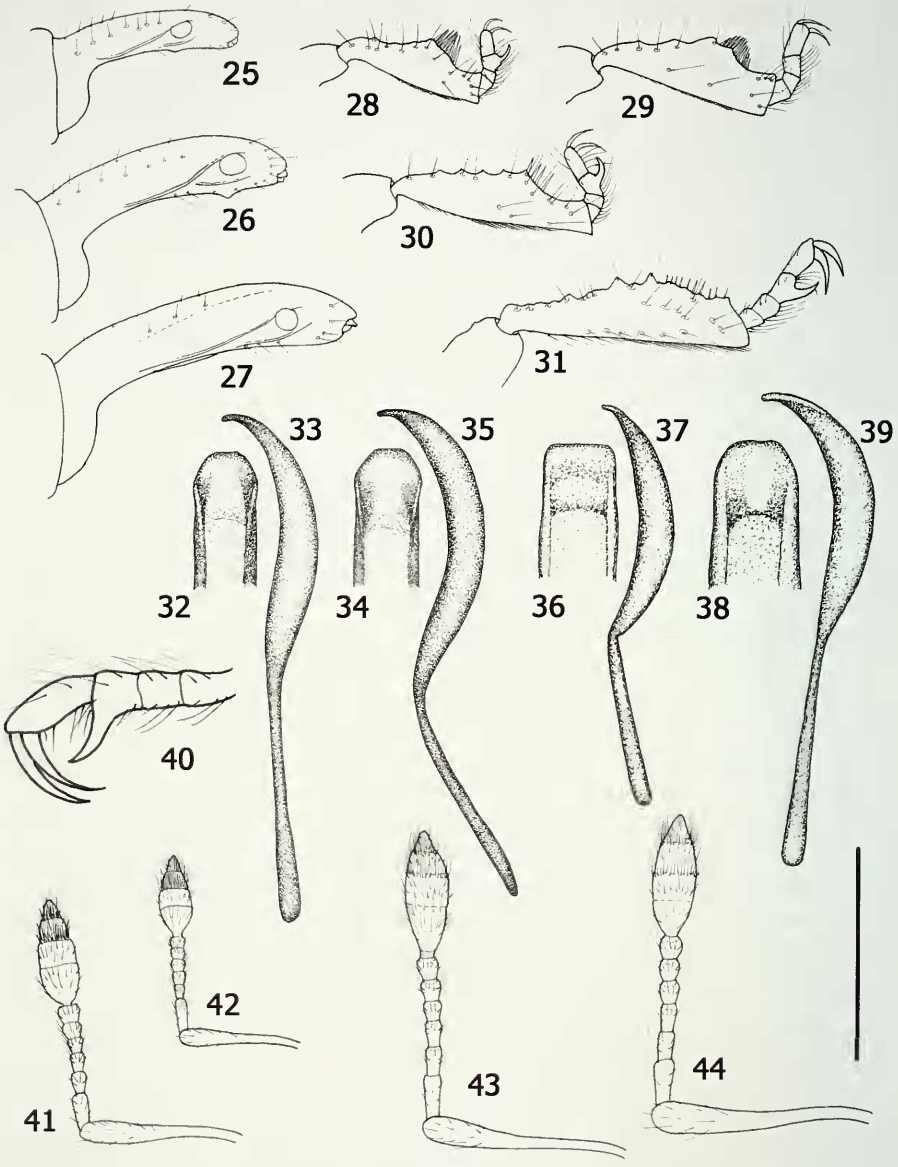
R. orientalis was described from Albarea, near Sospel. Several specimens from the immediate surroundings of Sospel (La Vasta and Col de Castillon) were examined. The range of variation mainly regards the dorso-lateral margins of rostrum, often slightly curvilinear, and the punctures on the dorsum of pronotum, usually large and dense, seldom smaller, and with interspaces nearly as wide as the punctures. Some specimens have slender fore tibia, with apparently more prominent teeth. The specimens from Italy, province of Imperia (Colle Melosa; Colle Gouta; Pigna and Upega) and those from the same province cited as *Pararaymondionymus ochsi problematicus* by Osella (1977: 54) belong to this species, which thus ranges from Sospel to the province of Imperia (Fig. 72); it seems associated to the low-montane to montane habitat, that is, from 600 m (Sospel) to about 2000 m (Colle Melosa), in mixed broadleaved forests, including chestnut and, in the sites of higher altitude, beech. The Italian specimens do not show peculiar and constant differences with respect to those from Sospel; variation in these specimens mainly regards width of pronotum, sometimes less broadened, and its puncturation, which can be dense and deep (Fig. 67) or shallower, with small punctures and broad interspaces (Fig. 68); in a few specimens pronotum is weakly transversely depressed before apex. The fore tibiae are also quite variable, sometimes not differentiated from those of the specimens from Sospel, but often narrower, less thickened at middle of their length and with sharper teeth.

R. orientalis is nearly sympatric with *R. sanfilippoi* (Osella & Giusto, 1985) in part of its range. This species can be distinguished from *R. orientalis* by the presence of a spine on the inner side of segment 3 of the ♂ tarsi; the ♀♀ are distinguished by the segment 2 of the funicle much shorter, barely longer than 3, the pronotum with sides more widened at middle, and with a shallow, but distinct, semicircular impression before the apex.

Raymondionymus longicollis Perris, 1869, sensu lato Figs 25-27; 28-30; 36-39; 41-42

Raymondionymus longicollis Perris, 1869: 29.

A) FORM FROM NORTHERN CORSICA: "Grotte d'Acorte, Pietra Corbara, 7.XI.1972, Corse, Leg. Curti M.", 1 ♀ 1 ♂; "Brando, Corse, Castello, 7.XI.1972, Leg. Curti M.", 1 ♀.



FIGS 25-44

Raymondionymus longicollis s.l., ♂, Corsica, Pietra Corbara: rostrum (25); fore tibia (28); aedeagus (36-37); antenna (42). *R. longicollis* s.l., ♀, Corsica, Lano: rostrum (26); fore tibia (29). *R. longicollis* s.l., ♂, Corsica, Col de Verde: rostrum (27); fore tibia (30); aedeagus (38-39); antenna (41). – *R. sanfilippoi*, ♂, France, Alpes Maritimes, M. Ferisson: fore tibia (31); aedeagus (32-33); antenna (43). *R. sanfilippoi*, ♂, Italy, Val Pesio: aedeagus (34-35); fore tarsus (40); antenna (44). – Bar: Figs 25-31, 33, 35, 37, 39, 41-44: 0.5 mm: Figs. 32, 34, 36, 38, 40: 0.25 mm.

b) Form from central Corsica: "Grotte de Lano, Lano, Corse, IX.1970, Leg. Curti M.", 1 ♀.

c) Form from central-southern Corsica: "Col de Verde, Corse, 2.XI.1972, Leg. Curti M.", 1 ♂.

Remarks. The five specimens examined come from different localities. Two ♂♂ and 1 ♀ come from north of Bastia; a ♀ was sampled in central Corsica, and a further ♂ is from Col de Verde, in the central-southern part of the island. Each locality, or geographical area, is colonized by specimens showing peculiar traits, although all these forms are closely related and apparently of monophyletic origin. The specimen from Col de Verde is more diversified, also for the aedeagus (Figs 36-39) and could probably be referred to a distinct species. However, as mutual differences are relatively limited, and the available material is very scarce, no definitive decision regarding the rank to be attributed to each form is taken; moreover, *R. longicollis* was simply described of «Corse» (Perris, 1869), and the description does not allow attributing the type specimen to any of the known populations. A complete taxonomic analysis will require more material from various localities of Corsica and the study of the type specimen. The ♂ of *R. longicollis* presents a spine in the inner side of segment 3 of the fore tarsi, indicating its phylogenetic affinity with species native to the western and maritime Alps.

Raymondionymus sanfilippoi (Osella & Giusto, 1985) Figs 31-35, 40, 43-44, 69

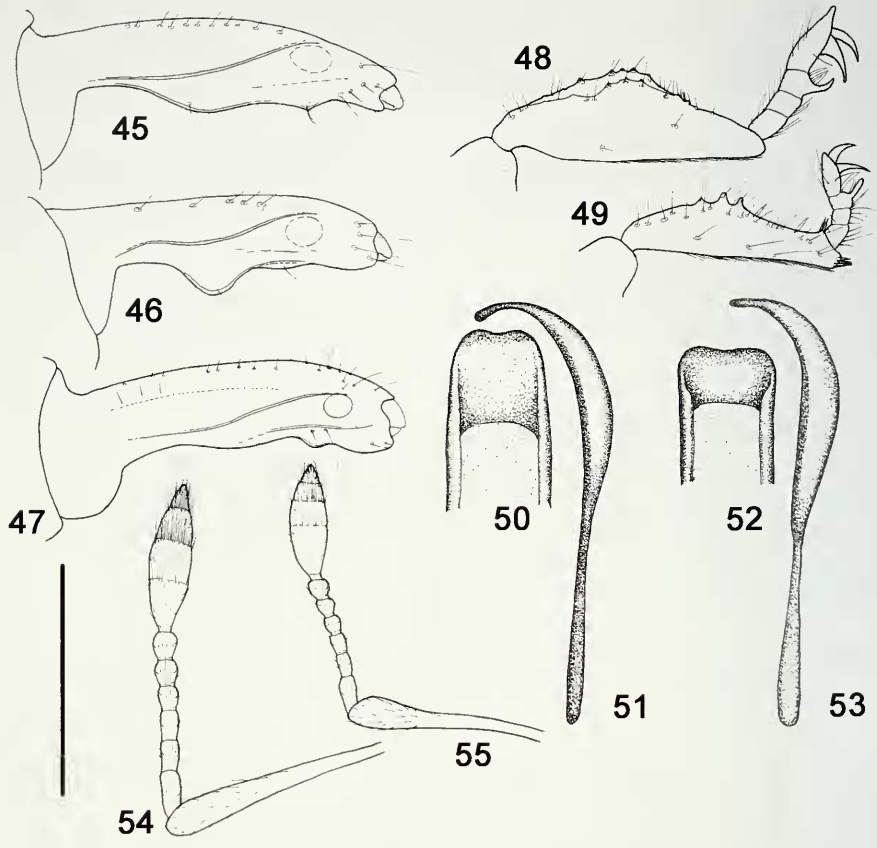
Pararaymondionymus sanfilippoi Osella & Giusto, 1985: 432.

Italy, Piedmont: "Val Pesio, Italie, Pont, m 1500, 22.VII.1973, Leg. Curti M.", 2 ♂♂ 1 ♀ (1 ♂ 1 ♀ MHNG; 1 ♂ MER). – France, Alpes Maritimes: "Ferisson, A. M., Gadelasque, 22.VIII.1973, Leg. Curti M. / lavage de terre à 2000-2200 m près de la bergerie", 1 ♂; "M. Ferisson, A. M., 2000, VIII", 1 ♂ 1 ♀ (1 ♀ MHNG; 1 ♂ OSL).

Remarks. Two specimens were listed in the «Materiale esaminato» paragraph of the original description (Osella & Giusto, 1985): a ♀ from «Val Pesio, Pian Creuse, m 1250» and another ♀, from «App. Ligure occ., Murialdo (SV)», a locality about 40 km east of Val Pesio, in the western Ligurian Apennine, high Bormida Valley. None of the two specimens was explicitly indicated as the holotype, but that from Murialdo was only doubtfully attributed to *R. sanfilippoi* (Osella & Giusto, 1985: 434): according to Art. 72.4.1 (ICZN, 1999) this act excludes this last specimen from the type series and the specimen from Val Pesio is thus the holotype. This is confirmed by two implicit indications: «Val Pesio» was reported as the «Loc. tip.» (type locality), and the caption of the illustrations (Osella & Giusto, 1985: 433, Figs 13-15; 18-19) refers to the specimen from Val Pesio as to the holotype.

The original description compared the new species with *R. gardinii*, the taxon most closely related morphologically, and included drawings of body, fore tibia and spermatheca.

The three specimens ex coll. Curti were collected at a slightly higher altitude, 1500 m instead of 1250 m. They have pronotum with smaller punctures, interspaces strongly microsculptured, matt, as wide as the punctures; middle keel indistinct in one specimen and barely visible in the others; punctures of the elytra smaller, as in *R. gar-*



FIGS 45-55

Raymondionymus zoiai, ♂, Italy, Piedmont, Crissolo: rostrum (45); fore tibia (48); aedeagus (50-51); antenna (54). *R. zoiai*, ♀, Italy, Piedmont, Crissolo: rostrum (46). – *R. curtii*, holotype: rostrum (47); fore tibia (49); aedeagus (52-53); antenna (55). – Bar: Figs 45-49, 51, 53, 54-55: 0.5 mm; Figs 50, 52: 0.25 mm.

dinii. The interval 6, near its base, has minute granules, which are less prominent than in *R. gardinii*. The male tarsi have a strong spine on segment 3, and the onychium has a very short, scarcely distinct prominence at the apex. Antenna, ♂ tarsus, aedeagus as illustrated in Figs 34-35, 40, 44.

The specimens from Mount Ferisson, in the Mercantour massif, show minor differences: pronotum with a distinct middle keel, slightly convex in the anterior half in two specimens; punctures on dorsum variable, dense, deeply impressed, irregular, with slightly convex interspaces in one specimen; smaller, with barely convex interspaces in the second and shallowly impressed, with flat wide interspaces in the third specimen. Interval 6 of the elytra usually with a row of sparse minutes granules. Pronotum a little larger, with more regularly curved sides. Aedeagus not significantly distinct (Figs 32-33), very similar to the aedeagus of *G. gardinii*.

The specimen ♀ from Murialdo shows some differences with respect to those from Val Pesio: shallower punctures on pronotum and elytra, pronotum slightly broader and more depressed apicad, more robust fore tibiae, with a different position of the teeth on the outer margin. The identification of this specimen is doubtful. In central-western Liguria, not far from Murialdo, *R. bartolii* (Osella & Giusto, 1985) and the very closely related *R. gardinii* (Osella, 1977) were described, respectively based on two and one specimens, and both are morphologically similar to *R. sanfilippoi,* also for the form of the aedeagus. Three more specimens, all ♀♀, found in the neighbouring localities of Altare and Nasino (Fig. 72), belong to this complex but could not be referred to any of the described taxa: specimens from each locality show in fact a peculiar morphology, and interpretation of taxonomy of the whole group requires more material. However, as also the specimen from Murialdo belongs to this group, it is preferable to exclude it from *R. sanfilippoi*, in order to maintain a morphological and biogeographical homogeneity to each of the described taxa in this complex. The range of *R. sanfilippoi* remains thus limited to the Maritime Alps, between the Mercantour massif at west and the Marguareis at east (Fig. 72), at relatively high altitudes, between 1250 and more than 2000 m.

New species for the French fauna

Raymondionymus curtii sp. n. Figs 47, 49, 52-53, 55, 61, 71

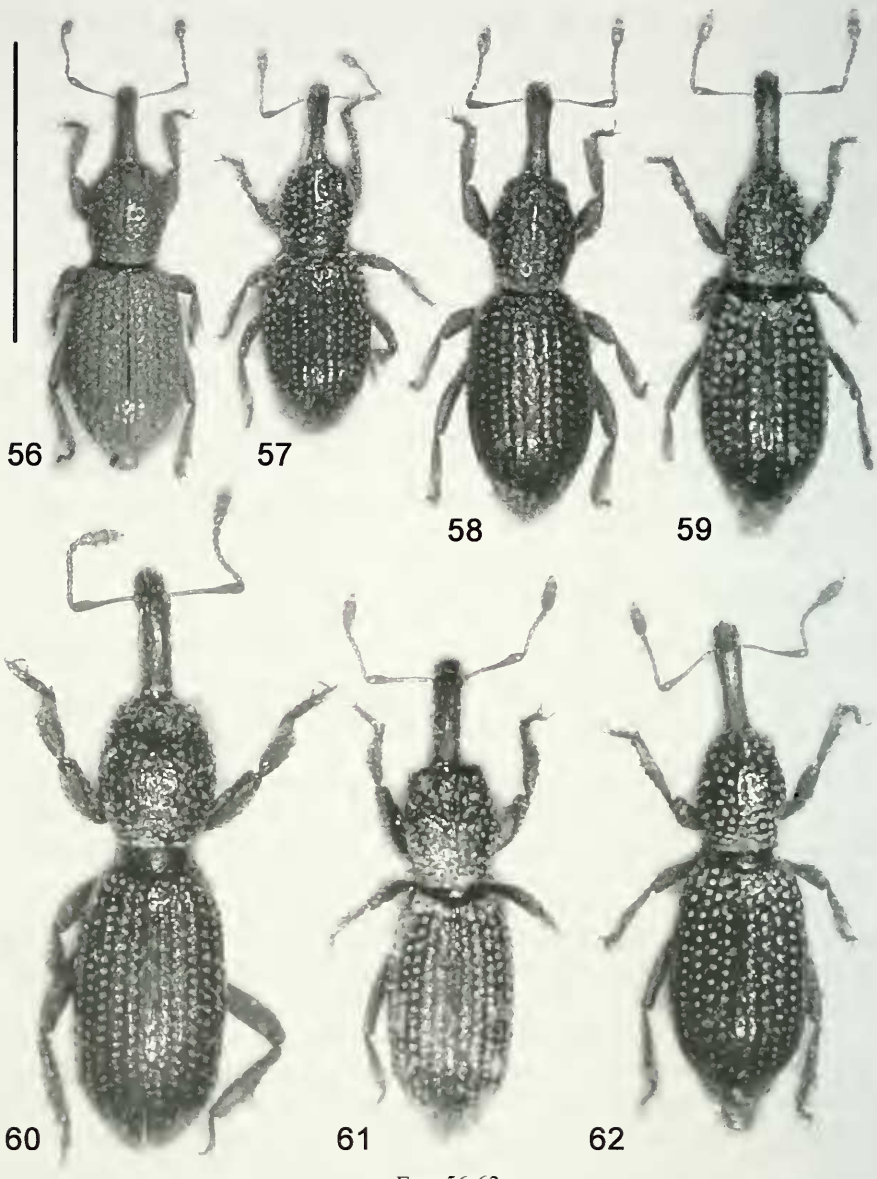
Type locality: Italy, Piedmont, Valle Varaita, Castello [44°37'N 07°03'E].

Holotype: ITALY, PIEDMONT: «Castello, Italie, Valle Varaita, 12.VI.1974, m 1500, Leg. Curti M.» 1 ♂ (MHNG, Curti collection).

DIAGNOSIS. A *Raymondionymus* morphologically and systematically related to *R. zoiai*, characterized by rostrum with the lower margin of scrobe scarcely expanded downwards; pronotum weakly narrowed apicad, with distinct semicircular shallow depression; elytra narrower; curved part of the apex of aedeagus shorter.

MEASUREMENTS. Length including rostrum: 3.12 mm. Rostrum: length 0.74 mm; width without the expansions of the scrobes: 0.17 mm; width including the expansions of the scrobes: 0.23 mm. Pronotum: length 0.77 mm; width 0.62 mm; length/width ratio 1.24. Elytra: length 1.60 mm; width 0.81 mm; length/width ratio 1.98.

DESCRIPTION. Body dark reddish, integument scarcely glossy, dorsum flattened. Rostrum subcylindrical, flattened dorsally, dorso-lateral margins rectilinear, weakly keeled and slightly darker near base; upper margin of scrobe expanded laterally, fully visible from above, weakly curved, with maximum width at mid of its length. Dorsum with trace of longitudinal wrinkles, lacking isolated punctures. In lateral view dorsum moderately and regularly curved; upper margin of scrobe sinuate, curved downwards at middle of its length; lower margin of scrobe weakly curved downwards but not distinctly expanded. Antenna short, scape weakly sinuate, strongly thickened at apex; segment 1 of the funicle cylindrical, 1.5x longer than wide; segment 2 subconical, isodiametric; 3 longer than 2; 4-6 globose; club large, elliptical, segments well distinct. Pronotum longer than wide, apex distinctly broader than base, sides strongly, sublinearly widened from base, maximum width at middle, scarcely converging apicad. Surface with dense and deep punctures, interspaces narrower than the punctures, with



FIGS 56-62

Body of *Raymondionymus* spp.: *R. ochsi*, ♂, France, Alpes Maritimes, Vence (56); *R. ochsi*, ♂, France, Alpes Maritimes, Eze (57). – *R. orientalis*, ♂, France, Alpes Maritimes, Col de Castillon (58); *R. orientalis*, ♂, Italy, Liguria, Colle Melosa (59). – *R. zoiai*, ♂, Italy, Piedmont, Crissolo (60). – *R. curtii*, holotype (61). – *R. problematicus*, ♀, France, Alpes Maritimes, Valberg (62). Bar: 2 mm.

distinct wrinkled microsculpture; median line narrow, convex, nearly keeled, well delineate from base to apex; anterior half with a shallow semicircular depression; dorso-lateral part with raised granules; dorsum and sides with stiff lifted setae, oriented

forwards, inserted on the hind margin of the punctures and on the granules. Elytra slender, long elliptical, base curved, sides very scarcely broadened, nearly sub-parallel for most of their length. Striae with dense, regularly impressed round punctures, smaller on declivity; intervals nearly as wide as the striae, narrower at base, weakly convex, with microscopic shallow punctures only visible at high enlargement, evenly spaced, preceded, on intervals 4 to 6 and on declivity, by minute dark granules, sharper on interval 6 than on intervals 4 and 5; each of the punctures bearing a lifted stiff seta, oriented backwards, as long as or, on sides and declivity, longer than the intervals. Fore femora thickened, with small granules on the outer side; fore tibiae moderately thickened in cross section, maximum width in the inner side before mid of their length, narrowed towards apex; outer margin with a few small granules and some long setae, lacking a sub-apical fringe, which is replaced by a few isolated short thick setae; tarsi short, fore tarsi with a spine on the inner side of segment 3; onychium sub-acute at apex. Middle and hind femora less thickened, not or indistinctly granulose on their outer margin. Hind tibiae slender, with sub-apical teeth moderately developed. Ventrites glossy, 1 and 2 with small punctures regularly impressed, interspaces of the punctures wider than the punctures. Aedeagus as illustrated in Figs 52-53.

Etymology. This species is named after Marc Curti, an entomologist with an extreme skill in sampling of endogeic insects, as it is also demonstrated by the extraordinarily rich material here studied.

Remarks. *R. curtii* is morphologically similar to *R. zoiai,* from which it differs by the smaller size, the lower margin of scrobe slightly curving downwards but not expanded as in the ♂ of *R. zoiai*; the sides of pronotum weakly converging at apex, with much more prominent granules; the elytra narrower, with distinctly raised granules on interval 6; the granules present also on intervals 4 and 5 and on declivity; the fore tibia less expanded and lacking a subapical fringe of setae; the onychium of male fore tarsi not expanded apically; the shorter apex of aedeagus. *R. sanfilippoi*, spread in the Maritime Alps between the Marguareis and the Mercantour massifs, differs by the upper margin of scrobe not expanded laterally when seen from above; the sides of pronotum regularly curved, its apex approximately as wide as base; the dorsum with the semicircular impression in the anterior half nearly indistinct; the elytra more convex, with slightly more rounded sides; the narrower striae and the flat and wider intervals, interval 6 with scarcely distinct granules; the setae on elytra irregularly spaced; the fore tibiae smaller and less thickened at middle in cross section.

Distribution. The new species, known so far of the upper part of Val Varaita, is a southern vicariant of *R. zoiai.* Investigations in the valleys south of Val Varaita are needed to define its distribution; researches in a beech forest at about 1000 m a.s.l. in Val Maira, the next valley south of Val Varaita, have proved so far negative for Raymondionymidae (Meregalli, personal observations).

Raymondionymus zoiai (Osella & Giusto, 1985) Figs 45-46, 48, 50-51, 54, 60, 70

Pararaymondionymus zoiai Osella & Giusto, 1985: 434.

Specimens in Curti collection:

Italy, Piedmont: "Crissolo, Pont, Italie, 28.VII.1973, Leg. Curti M.", 1 ♂.

OTHER SPECIMENS EXAMINED:

ITALY, PIEDMONT: «Piemonte, Valle Po, Crissolo, faggeta, m 1200, 13.VIII.1996, S. Zoia legit», 1 ♀ (MER).[1]

REMARKS. This species was based on 2 ♀♀ from of Rorà (the type locality) and a further ♀ from Crissolo. The specimens from Crissolo differ from those from Rorà by some traits of limited importance: upper margin of scrobe slightly sinuate in lateral view, curved downwards; expansion of the lower margin of scrobe broader and more regularly expanded in the ♀ (see below for remarks on the secondary sexual characters); rostrum on dorsum with shallow irregular longitudinal wrinkles, lacking clearly differentiated punctures; segment 5 of antennal funicle isodiametric; pronotum more robust, with more rounded sides; punctures on its dorsum shallower, smaller and more spaced; punctures of elytra variable, smaller in the ♀, which has thus intervals as wide as the striae, and completely flat and larger in the ♂, which has narrower and weakly convex intervals; granules on interval 6 more evident; ventrites 1 and 2 with smaller and shallower punctures. This species presents the most striking dimorphism in secondary sexual characters in the whole family Raymondionymidae. The ♂ has underside of rostrum with a preapical acute prominence and expansion of lower margin of the scrobe less developed (Figs 45-46). The fore tibiae are strongly thickened in cross section at middle and their inner side is more expanded at this level; the fore tarsi have a spine on segment 3, as typical of this group, and in addition onychium has an evident projection at apex; moreover, claws are very robust, flattened.

Raymondiellus doderoi (Ganglbauer, 1906)

Raymondionymus (Raymondiellus) doderoi Ganglbauer, 1906: 166.

ITALY, SARDEGNA: "Sindia, Sardaigne, 9.III.1979, Leg. Curti M. / Mt. San Antonio, lavage terre chénes-liège", 1 ex.

Ferreria marqueti apennina (Dieck, 1869)

Raymondia apennina Dieck, 1869: 10.

ITALY, TOSCANA: "Carrare, Italie, 23.XII.1975, Leg. Curti M.", 1 ex. – ITALY, EMILIA: "M.te Fumaiolo, Verghereto, 22.VI.1976, Leg. Curti M. / lavage de terre source du Tevere", 2 exs – ITALIA, MARCHE: "Monte Nerone, Cagli, 24.VI.1976, Leg. Curti M. / davant le relais de television sous une grosse pierre", 1 ex.

Ferreria doriai (Osella, 1977)

Raymondionymus doriai Osella, 1977: 77.

ITALY, LIGURIA: "S. Lorenzo, Gênes, 13.V.1973, Leg. Curti M.", 4 exs (3 exs MHNG; 1 ex. MER); "Ruta, Ligurie, 13.V.1973, Leg. Curti M.", 3 exs; "Uscio, Ligurie, 17.V.1973", 6 exs (4 exs MHNG; 1 ex. MER; 1 ex. OSL).

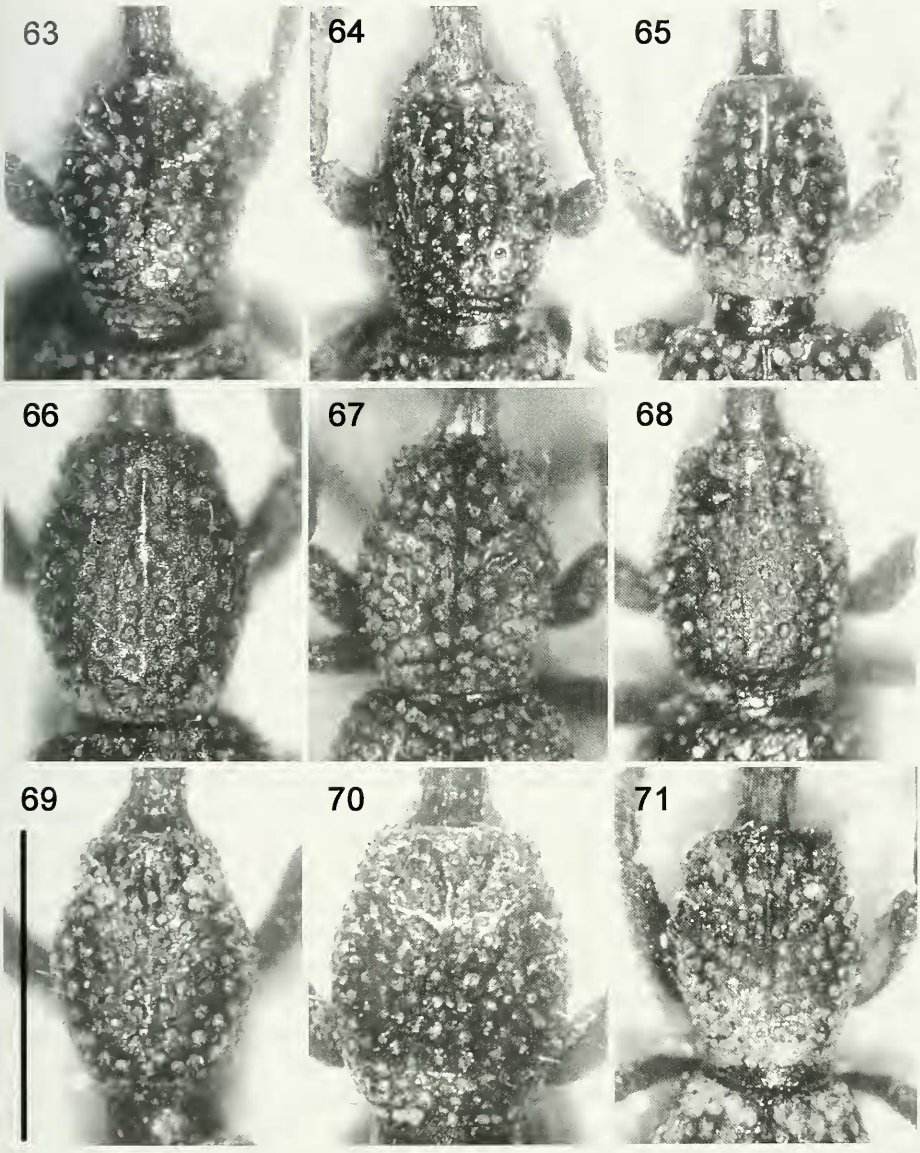
Ubychia leonhardi leonhardi Reitter, 1914

Ubychia Leonhardi Reitter, 1914: 82.

Ubychia leonhardi leonhardi Reitter, 1914: Osella, 1977: 141-142.

---

[1] *Note added in proof.* While the paper was in press, another specimen was found, expanding the range of *F. zoiai* to Val Germanasca (a tributary of Val Chisone): Val Germanasca, Chiabrano, Grotta 'Tuna dal Diau' [44°56'55.9" N 7°6'25.3" E], m 1150, X.2005, P.M. Giachino leg., 1♂.



Figs 63-71

Pronotum of *Raymondionymus* spp.: *R. ochsi*, ♂, France, Alpes Maritimes, Vence (63); *R. ochsi*, ♂, France, Alpes Maritimes, Eze (64). – *R. problematicus*, ♀, France, Alpes Maritimes, Covillote (65). – *R. orientalis*, ♂, France, Alpes Maritimes, Col de Castillon (66); *R. orientalis*, ♂, Italy, Liguria, Colle Melosa (67); *R. orientalis*, ♀, Italy, Liguria, Pigna (68). – *R. sanfilippoi*, ♂, France, Alpes Maritimes, M. Ferisson (69). – *R. zoiai*, ♂, Italy, Piedmont, Crissolo (70). – *R. curtii*, holotype (71). – Bar: 1 mm.

ITALY, LOMBARDY: "Oltre il Colle, Bergamo, 20.VI.1976, Leg. Curti M.", 1 ex.; "M. Pora, Italie, Dorea, 20.VI.1976, 1800, Leg. Curti M.", 7 exs; "Oneta, Cantoni, Bergamo, 20.VI.1976", 3 exs – ITALY, VENETO: "Monticchio, Italia, Verona, 30.V.1979, Leg. Curti M.", 1 ex.; "Velo, Verona, Italie, 25.V.1975, Leg. Curti M.", 4 exs; "Velo, Verona, Italie, 28.V.1975, m 1300, Leg. Curti M.", 4 exs; "Velo, Verona, Italie, 30.V.1975, Leg. Curti M." 15 exx, (11 exs MHNG; 2 exs MER; 2 exs OSL); "Velo, Verona, Oltre il Colle cfr.(?)" [*note*: this indication probably refers to a correlation of these specimens with those from Oltre il Colle], 2 exs

REMARKS. *Ubychia leonhardi* is presently known from the Prealps of Lombardy, Val Camonica (type locality) and Val Brembana, where the nominal subspecies is present, and from the Ticino Valley, in Southern Switzerland, with subspecies *U. leonhardi ticinensis* Osella, 1977. The examined material expands the range of the species towards east, up to the Verona Prealps. The specimens from Veneto show very small differences with respect to those of *U. leonhardi leonhardi* from Lombardy: the elytra are slightly more constricted in the apical half and the median expansion of the fore tibiae is usually rounded, seldom sub-angular as in the majority of the specimens from Oltre il Colle, a locality in Val Brembana. No significant differences could be found in the structure of the aedeagus.

SYSTEMATIC REMARKS ON THE GENUS *RAYMONDIONYMUS*

A phylogenetic analysis of the genus *Raymondionymus* is beyond the scope of the present contribution. However, short and preliminary notes allow to recognize apparently monophyletic groups and to underline some aspects of the distribution. Based on the absence or presence of a spine on segment 3 of the ♂ fore tarsi, the species can be included into two groups, the *R. perrisi* and the *R. fossor* groups. This secondary sexual character is very peculiar and does not appear elsewhere in the family Raymondionymidae, so its shared presence should be considered as a synapomorphy for the *R. fossor* group. Secondary sexual characters in the legs are not uncommon in Curculionoidea, but the presence of a tarsal spine is unusual; it appears in some genera of Apionidae, such as *Protapion* Schilsky, 1908; however, morphology of the spine is completely different between these Apionidae, which have usually an expanded and modified segment 1 of the fore tarsi and other significant secondary sexual characters in the legs (see Russell, 2004), and the *Raymondionymus*. So far, this trait has not been described for other taxa of Curculionoidea.

The following species lack the spine and do not show any particular secondary sexual character other than the usual slight depression of the male ventrites and the rostrum weakly shorter in the ♂: *R. laevithorax* (Perris, 1875); *R. laneyriei* Hervé, 1949; *R. lavagnei* Mayet, 1898; *R. ochsi* Hervé, 1949; *R. orientalis* Hervé, 1953; *R. perrisi* (Grenier, 1864); *R. problematicus* Hervé, 1949; *R. stricticollis* (Reitter, 1894). They are spread in southern France and western Liguria and, along the Apennines, reach central Italy, with *R. laevithorax* in Corsica. Based on morphology and distribution, some sub-groups, not yet fully analysed, are identifiable; among these, *R. ochsi* and *R. orientalis* show a high morphological affinity and may be considered as vicariant species adapted to distinct habitats, the xerophyll forest for *R. ochsi* and the more humid and fresh broadleaved forest for *R. orientalis*. No male

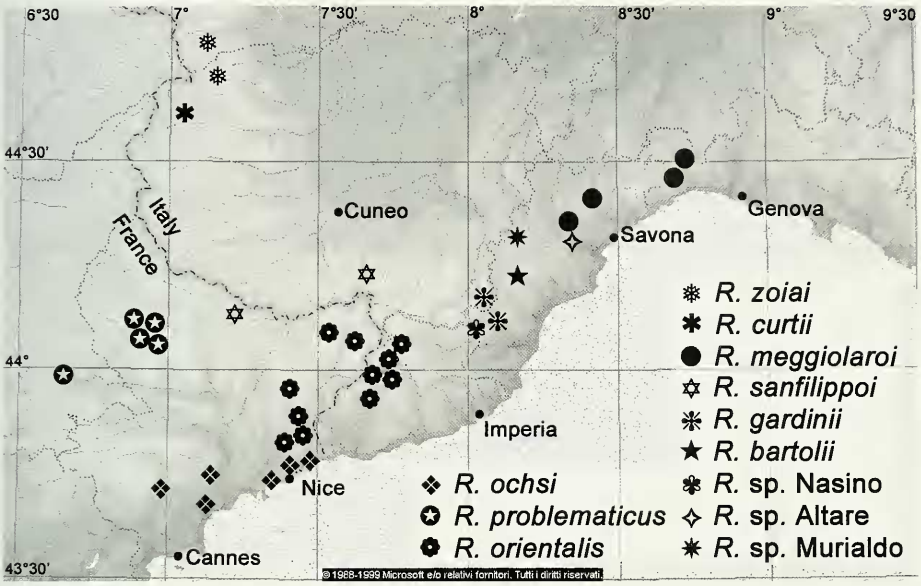


FIG. 72

Distribution of some species of *Raymondionymus* of the Western Alps [map from Encarta World Atlas 2000 (Microsoft Corporation), elaborated with Photoshop 7.0 (Adobe Systems Incorporated)].

specimen surely referable to *R. hoffmanni* Hervé, 1949 was examined, hence this species is not included in either of the groups.

The spine on segment 3 of the ♂ fore tarsi is shared by the Corsican *R. longicollis* Perris, 1869 and several other species: *R. andreinii* (Osella, 1977); *R. bartolii* (Osella, 1977); *R curtii* sp. n.; *R. fossor* (Aubé, 1861); *R. gardinii* (Osella & Giusto 1985); *R. magnificus* (Osella, 1977); *R. meggiolaroi* (Osella, 1977); *R. mingazzinii* (Osella & Abbazzi, 1985); *R. mirabilis* (Osella, 1977); *R. sanfilippoi* (Osella & Giusto, 1985); *R. zoiai* (Osella & Giusto, 1985). The range of this group is thus partially overlapping with that of the previous group, being present in Southern France, central-western Liguria, and central Italy; it expands to the southern Apennines with two species. Monophyly of these species is sustained by other characters, such as habitus, structure of the genitalia, etc. Pronotum, in most of the species, is slightly globose and convex at middle, narrowed apically; usually it has a distinct transversal depression before apex. Each species has a limited distribution, in some cases restricted to a single valley or mountain. Three species (*R. meggiolaroi, R. magnificus* and an undescribed species from Lazio) differ from the other entities of this group for the synapomorphy of a broad pronotum, whose sides are strongly and regularly rounded from base to apex, and whose dorsum shows a deep semicircular or triangular depression on the anterior half. They have broader elytra, with a lower length/width ratio. These three species colonize forested habitats of the central-western Ligurian Alps (*R. meggiolaroi*) and reach southern Italy along the Apennines with *R. magnificus*, with the new

undescribed species in-between. The wide range of this group and the limited morphologic variations among the species which compose it are remarkable, particularly when compared with the usually very restricted range of the other subunits. *R. zoiai* shows a peculiar dimorphism in the secondary sexual characters which is unparalleled in the other species; also the geographical vicariant *R. curtii* may show a strong sexual dimorphism, at least basing on the morphology of the rostrum and fore legs of the holotype ♂; in *R. longicollis* and in the other continental species the secondary sexual characters are limited to the presence of the spine on segment 3 of the ♂ fore tarsi. The *R. fossor* group appears thus to be highly diversified, comprising some possibly monophyletic subgroups, each with its own range. Only the nominal species, *R. fossor*, was recorded from France; this species is strictly localized near the Mediterranean coast and, perhaps not surprising for paleogeological considerations, is morphologically similar to *R. longicollis* from Corsica; no other species have ever been found in the French side of the alpine chain, apart for the very marginal presence of *R. sanfilippoi* in the Mercantour massif. It is impossible to establish with full confidence whether the absence is real because these species are very difficult to sample. However, the absence of species of the *R. fossor* group from the French alpine territories seems at least very probable, particularly for the Maritime Alps, which have been extensively sampled by Curti. The presence of taxa of this group in the Italian side of the Varaita, Po and Pellice valleys is not surprising and was probably determined by the floristic continuity along the foothills between the eastern side of the Cottian and Ligurian Alps and the forests of the Maritime Alps, which occurred during the late Tertiary at least (Zheng, 1990; Martinetto, 1996; Suc *et al.*, 1999); the distribution pattern of these species of *Raymondionymus* is paralleled by the distribution of several other endogeic Coleoptera of the western Alps, such as some Carabidae (Casale & Vigna Taglianti, 1992; Vigna Taglianti, 1969; also Casale, personal communication about the distribution of the species of the genus *Doderotrechus* Vigna Taglianti) and Cholevidae (Giachino & Vailati, 1993). The northern limit of distribution seems to be coincident with the Chisone valley; this limit may have been determined by paleogeological, paleovegetational and paleoclimatical reasons, which may have prevented an expansion towards north, or cancelled any previous presence. The localization of several taxa nearly sympatric in the western Ligurian Apennines and in the Ligurian Alps, and the strong morphological differentiation shown by the specimens from each locality, indicate that this area represented, and probably still represents, an important centre of diversification for this complex (Fig. 72).

ACKNOWLEDGEMENTS

We are indebted to Ivan Löbl (MNHG) for the loan of the specimens ex coll. Curti and Hélène Perrin (Museum national d'histoire naturelle, Paris) for the loan of specimens of *Raymondionymus* of the Hoffmann collection. Consolata Siniscalco (Dept. Plant Biology, University of Turin) and Edoardo Martinetto (Dept. Earth Sciences, University of Torino) supplied useful documentation on paleovegetation of the western Alps.

REFERENCES

CASALE, A. & VIGNA-TAGLIANTI, A. 1992. I Coleotteri Carabidi delle Alpi occidentali e centro-occidentali (Coleoptera, Carabidae). *Biogeographia* 16: 331-399.

DIECK, G. 1869. Beitrage zur subterranean Käferfauna. *Diagnosis blinden Käfer*: 7-10.

GANGLBAUER, L. 1906. Revision der Blindrüsslergattungen *Alaocyba* and *Raymondionymus*. *Münchner Koleopterologische Zeitschrift* III: 135-170.

GIACHINO, P. M. & VAILATI, D. 1993. Revisione degli Anemadinae Hatch, 1928 (Coleoptera Cholevidae). *Monografie di «Natura Bresciana»* 18: 314 pp.

GRENIER, A. 1864. Description de *Raymondia perrisi*. *Annales de la Société entomologique de France* IV: 137-140.

HERVÉ, P. 1949. Sur les espèces du genre *Raymondionymus* Woll. dans les départements du Var et des Alpes-Maritimes. *Revue française d'Entomologie* XVI (3): 131-146.

HERVÉ, P. 1950. Sur les espèces du genre *Raymondionymus* Woll. dans les départements du Var et des Alpes-Maritimes. *Revue française d'Entomologie* XVII (1): 34-37.

HERVÉ, P. 1953. Étude sur le genre *Raymondionymus* Woll. dans les département du Var et des Alpes-Maritimes. *Annales de la Société des Sciences Naturelles de Toulon et Var* 5: 9-11.

HOFFMANN, A. 1958. Coléoptères Curculionides (Troisième Partie). *Faune de France* 62: 1209-1839.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE 1999. International Code of Zoological Nomenclature. Fourth Edition, adopted by the International Union of Biological Sciences. *London, The International Trust for Zoological Nomenclature*, i-xxix + 306 pp.

MARTINETTO E. 1996. Pliocene vegetation at the western margin of the Po Basin. *Allionia* 34: 349-355.

MAYET, V. 1898. Les Coléoptères hypogées dans l'Herault. *Bulletin de la Société entomologique de France*: 84-88.

OSELLA, G. 1977. Revisione della sottofamiglia Raymondionyminae. *Memorie del Museo Civico di Storia Naturale di Verona (II serie). Sezione Scienze della Vita* 1: 162 pp.

OSELLA, G. & ABBAZZI, P. 1985. Quattro nuove specie di Curculionidi dell'Apennino (Coleoptera). (XXXIV Contributo alla conoscenza della curculionidofauna endogea). *Redia* 68: 467-484.

OSELLA, G. & GIUSTO, C. 1985. Nuove specie di Curculionidi del suolo paleartico-occidentali. *Bollettino del Museo Civico di Storia Naturale - Verona* 10 (1983): 425-440.

PERRIS, E. 1869. Descriptions de quelques Coléoptères nouveaux, rectifications et notes. *L'Abeille* 2 (1): 1-29.

PERRIS, E. 1875. Descriptions de quelques insectes jugés nouveaux. *L'Abeille* 13 (3, 1): 1-81.

REITTER, E. 1914. *Ubychia Leonhardi* sp. n. *Koleopterologische Rundschau* 3: 82.

RUSSELL, M. 2004. Apionidae of the Western Palaearctic. Volume 2. Piezotrachelini (I): *Protapion* Schilsky, 1908. *Crocodile Press, Peterborough,* 80 pp.

SUC J.-P., FAUQUETTE, S., BESSEDIK, M., BERTINI, A., ZHENG, Z., CLAUZON, G., SUBALLYOCA, D., DINIZ, F., QUÉZEL, P., FEDDI, N., CLET, M., BESSAIS, E., BACHIRI TAOUFIQ, N., MÉON, H. & COMBOURIEU-NEBOUT, N. 1999. Neogene vegetation changes in West European and West circum-Mediterranean areas. *In:* AGUSTI J., ROOK, L. & ANDREWS, P. (Eds). Hominoid evolution and climatic change in Europe, 1. The evolution of Neogene terrestrial ecosystems in Europe. *Cambridge University Press*: 378-388.

ZHENG, Z. 1990. Végétations et climats néogènes des Alpes maritimes franco-italiennes d'après les données de l'analyse palynologique. *Paleobiologie continentale* 17: 217-244.

TALLIS, J. H. 1991. Plant Community History. Long term changes in plant distribution and diversity. *Chapman and Hall, London, New York, Tokyo, Melbourne, Madras,* iii-x + 398 pp.

VIGNA TAGLIANTI, A. 1969. Un nuovo *Doderotrechus* cavernicolo delle Alpi occidentali (Coleoptera, Carabidae). *Fragmenta entomologica* 6: 253-269.